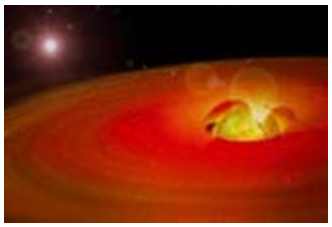


Planet Puzzle: The Mystery of the Disappearing Disks

SCIENCE TUESDAY

By Robert Roy Britt
Senior Science Writer
posted: 05:56 am ET
03 June 2003

NASHVILLE -- The raw material for planet formation around several newborn, Sun-like stars disappears rather quickly, a new study has discovered. Astronomers are puzzled, but separate research may provide a simple and convenient answer.

At the American Astronomical Society's 202nd meeting held here last week, one team described their examination of four star clusters, dense stellar nurseries thought to be the sorts of chaotic places where most stars are born. Our own Sun may have began in such a place, then been gravitationally booted out later on.

The researchers found that the dust around the young stars dissipates more quickly than the present theory deems necessary to build planets.

Building planets

The leading planet formation theory -- which nearly all astronomers now agree has problems -- goes like this: When material collapses to form a star, leftover gas and dust swirls around it in a pancake-like disk. The dust collides and builds rocks that eventually grow into large, potential planets called planetesimals.

Some planetesimals grow larger and survive an impact-rich environment to become like Earth or Mars. Others, farther out, use their gravity to attract gas and end up like Jupiter. The process for building a gas giant planet is thought to take about 10 million years.

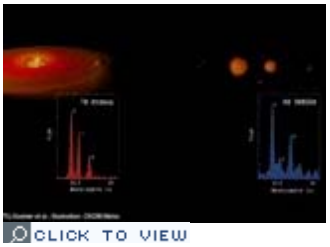
But around dozens of stars in the clusters, the dust is 90 percent gone in about 5 million years, said Elizabeth Lada of the University of Florida, who

SCIENCE TUESDAY

Visit SPACE.com to explore a new science feature each Tuesday.

>>Go to Science Tuesday archive page

Images



led observations with a Spanish radio telescope called IRAM.

In roughly half the cases, the dust is nowhere to be found after a mere 3 million years.

Similar recent research showed that outer portions of protoplanetary disks -- the gas and dust -- in the most extreme stellar environments can evaporate in 100,000 years, leading some astronomers to suggest that giant planet formation might be rare. But now that more than 100 weighty planets have been discovered around Sun-like stars, most of which were probably born in star clusters, it's clear that large, gaseous planets are not rare.

Last year another theorist mapped out a new method for making giant planets very quickly, by having them simply collapse into existence.

Lada and her colleague, Karl Haisch from the University of Michigan, speculate that planet formation might occur more quickly than theory holds.

"It implies that the building blocks of planets, called planetesimals, must form very quickly," Lada said. Further, because the conventional view of the process is that gas and dust hang around together, she explained, perhaps a Jupiter in the making has very little time to develop.

"If the gas is coupled to the dust, which we expect it should be, that means that the formation of the gas giant planets may occur much more quickly than previously thought."

Artist's conception of two young star systems observed by the Chandra X-ray Observatory. Data from the newborn star at left indicate X-rays are kicked up by matter falling onto the star. The right star is 10 million years old and its X-ray emissions look similar to our Sun's, meaning the disk of gas and dust is probably gone and planets may be partly or fully built.

Related SPACE.com STORIES

- Hot Deal! Pluto, the Last Oasis for Life
- Incredible Shrinking Planet May Become Liquid Lava World
- Deadly Dance: Giant Planet Found Orbiting Huge Star
- Alien Worlds through Artists' Eyes
- Wild New Theory for Building Planets

TODAY'S DISCUSSION

What do you think of this story?

>>Uplink your views

That view, which headlined several newspaper and Internet stories last week, is not supported by separate research presented in the same session at the conference, however.

Hiding in plain sight

Another team studied similar Sun-like stars and came away with a different interpretation.

Jeff Bary and David Weintraub of Vanderbilt University employed the National Optical Astronomical Observatory at Kitt Peak, Arizona to find ample hydrogen around a dozen young stars that had apparently lost their dust disks.

Their conclusion is convenient: Gas and dust are not coupled, and the dust is not there because it has coagulated into larger objects. Importantly, larger objects -- things the size of rocks, boulders or even moons -- have less total surface area than bits of dust, and so they reflect less light.

"If the tiny little pieces of material have collected into big things, Elizabeth [Lada] can no longer detect them," Weintraub said.

He is not ready to draw firm conclusions, however, since the results involve only a few stars.

"It's conceivable that all of the material is gone," Weintraub said. "But it's also conceivable that the planet-building process is well on its way after 3 million years, such that most of the material is simply no longer detectable because it's buried inside moon-sized objects." Planet formation might still take 10 million or 20 million years, he said, which means present theory could remain relatively intact.

Joel Kastner, of the Rochester Institute of Technology, presented novel observations from NASA's Chandra X-ray Observatory that show dust disks around young stars go away inside 10 million years, evidence he says supports Weintraub's suggestion that the dust has coalesced into larger, invisible objects.

"You just connect the dots and there's a high probability that planets are forming," Kastner told *SPACE.com*.

Muddled meaning

But what does all this mean?

In a press release, Weintraub and Bary said that if further work shows their conclusions to be right, then "solar

systems similar to our own may be a common sight in the universe." It is a sentiment that has gained steam over the past three years or so.

But in an interview, Weintraub was more cautious. He pointed out that while there might be other Earth-like planets out there, present technology can't find them and there's no proof any exist. Unlike many astronomers who are highly optimistic on this point, he has doubts.

Giant planets appear to be common, Weintraub and others say, but many of the huge worlds already found are far more massive than Jupiter and orbit extremely close to their host stars. Nobody has figured out for sure how these planets got there, but they probably spiraled inward over time. If so, they would have wiped out any Earth-sized planets along the way.

A handful of other solar systems have giant planets farther out. The only thing that's known for sure is that solar systems come in diverse arrangements.

Back to the central question: Are solar systems like ours common?

"I think 20 years ago we all knew the answer, and it was *yes*," Weintraub said. "But we've learned a lot since then. Now I think the answer is a whole lot harder. Now I'm more of a skeptic. I think the answer is going to be *no*."

- **More Extrasolar Planet News**
- **Complete Coverage of 202nd AAS Meeting in Nashville**
- **Astronotes**

SPACE.com TOP STORIES

- X Prize Rejects Gravity Control Rocket Group
- Image of the Day: Beagle 2 Landing Site as a Waterworld
- Does NIMA Need a Map? Agency Hit for Audit Process Flaws
- Next Mars Rover Launch On Schedule -- For Now
- Air France Concorde Readied for Display at Smithsonian
- Former, Current Astronauts Satisfied with NASA's Safety Efforts, But Live with Risk
- X-ray Observations Confirm Dark Matter is Mostly Cold
- SPACE.com: More News Headlines
- Station Crew Spots Small Unknown Object Floating Nearby
- The Summer of Mars: What You'll See, How to Observe